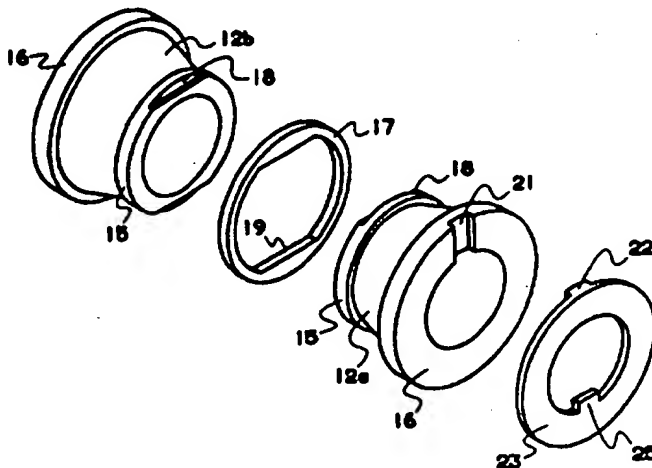




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: <b>PCT/GB96/00102</b></p> <p>(22) International Filing Date: <b>18 January 1996 (18.01.96)</b></p> <p>(30) Priority Data: <b>9501148.2</b>      <b>20 January 1995 (20.01.95)</b>      <b>GB</b></p> <p>(71) Applicant (for all designated States except US): <b>THE TIMKEN COMPANY [US/US]; 1835 Dueber Avenue S.W., Canton, OH 44706-0930 (US).</b></p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): <b>DRIVER, Richard [GB/GB]; 33 Anderson Drive, Kettering, Northamptonshire NN15 5DG (GB). READ, Neil [GB/GB]; 9 Beech Close, Bugbrooke, Northampton NN7 3RB (GB). CURTIS, Ian [GB/FR]; 20, rue des Francs, F-68750 Bergheim (FR).</b></p> <p>(74) Agent: <b>PERKINS, Sarah; Stevens, Hewlett &amp; Perkins, 1 Serjeants' Inn, Fleet Street, London EC4Y 1LL (GB).</b></p>	<p>(81) Designated States: <b>BR, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</b></p> <p><b>Published</b> <i>With international search report.</i></p>	

(54) Title: BEARING ARRANGEMENTS



## (57) Abstract

The inner race ring (12) of a bearing arrangement, suitable for use with the floating axle of heavy duty vehicles, has two conical bearing surfaces or raceways (12a, 12b) terminating at either end in ribs (15, 16). The smaller ribs (15) of the raceways include flats (18) which cooperate with flats (19) on a locking ring (17) whereby the raceways (12a, 12b) may be held together in fixed rotational relationship. Moreover, the bearing arrangement further includes a washer (23) having a finger (22) which cooperates with a groove (21) in the outer face of one of the larger ribs (16) of the raceways so that the washer (23) is also held in fixed rotational relationship with respect to the raceways (12a, 12b). A tang (25) on the washer (23) which cooperates with a keyway in an axle or the like ensures the washer and thereby the raceways are held in fixed rotational relationship with respect to the axle or the like. By ensuring all elements of the inner race ring of the bearing arrangement are held in fixed rotational relationship fretting corrosion of the axle or axle casing, for example, may be reduced.

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## BEARING ARRANGEMENTS

The present invention relates to bearing arrangements and is more particularly concerned with bearing arrangements which reduce relative rotation of the inner races with respect to the shaft.

According to this invention there is provided a bearing arrangement comprising inner and outer members which are rotatable relative to each other and rolling elements therebetween, the inner member having first and second portions each defining on their radial outer surface a raceway and a locking device having means for engagement with each of the first and second portions for holding the first and second portions in a substantially fixed rotational relationship, and further including mounting means for engagement with the first or second portions and adapted for mounting on a shaft or the like in a substantially fixed rotational relationship, the mounting means and the first or second portions having cooperating means for holding the mounting means and the first or second portions in a substantially fixed rotational relationship.

Preferably, the locking device includes at least one discontinuous surface which cooperates with a discontinuous surface on each of the first and second portions.

The locking device may further include radially inwardly directed lugs for engagement in grooves provided in the first and second portions.

Also, a recess may be provided in an axial outer face of the first and/or second portions and the mounting means may be in the form of a disc having a projection for engagement in the recess.

The mounting means may include a tang for engagement in a keyway provided in the shaft or the like.

One embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a bearing arrangement in accordance with the present invention;

Figure 2 is an enlarged exploded view of the inner race rings of the bearing arrangement of Figure 1;

Figure 3 shows a further embodiment of the cones of the inner race ring in accordance with the present invention;

5           Figures 4a and 4b show a second embodiment of a locking ring in accordance with the present invention;

Figure 5 shows a third embodiment of the cones of the inner race ring in accordance with the present invention; and

10           Figures 6a and 6b show a third embodiment of a locking ring in accordance with the present invention.

Referring to Figure 1, a shaft 10 is mounted for rotation in a tube or casing 11. Mounted about the tube 11 is a packaged bearing arrangement incorporating an inner race ring 12 and an outer race ring 13. Bearing elements 14 are provided in rolling engagement with the raceways in the race rings. The inner race ring 12 consists of an outer cone 12a located adjacent the end of the tube 11 and an inner cone 12b located distant from the end of the tube 11.

As may be more clearly seen in Figure 2, both the outer and inner cones 12a, 12b have a generally conical outer surface which defines the raceway and which is terminated at each end in circular ribs. The cones 12a, 12b are arranged so that the smaller ribs 15 are adjacent each other and held together by a clip 20 whereas the large ribs 16 face outwardly from the bearing arrangement.

The large rib 16 on the inner cone 12b is conventional in design. The small rib 15 on the other hand has opposing cut-away portions or rib flats 18 on its outer face. A locking ring 17 is also provided which has a generally circular inner diameter which is slightly greater than the outer diameter of the small rib thereby enabling the locking ring 17 to form a snug fit about the small rib 15. The generally circular inner diameter of the locking ring 17 is interrupted by opposing ring flats 19 which are dimensioned to engage with the rib flats 18 of the small rib 15. When the locking ring 17 is mounted on the

small rib 15 the engagements of the respective flats 18, 19 prevents relative rotation of the inner cone with respect to the locking ring 17.

The small rib 15 of the outer cone 12a is substantially identical to the small rib of the inner cone 12b, and includes opposing rib flats 18. Hence  
5 when the outer and inner cones 12a, 12b are connected by means of the clip 20, the locking ring 17 is located about and extends across the junction of the two cones and the ring flats 19 engage with the rib flats 18 on each of the cones. In this way not only is relative rotation between the inner cone and the locking ring prevented but also relative rotation between the inner and outer  
10 cones is prevented.

A slot or recess 21 is provided in the outer face of the large rib 16 of the outer cone 12a. In Figure 2 the slot 21 extends radially across the width of the face of the large rib 16. However the slot 21 need not extend over the whole width and alternative arrangements are envisaged in which the  
15 slot 21 terminates distant from the inner diameter of the cone 12a. The slot 21 is provided for engagement with a finger or tooth 22 which is provided on a washer 23. The washer 23 is otherwise generally conventional in design and is provided between the outer end of the inner race ring 12 and the securing nut 24. The washer 23 includes an inwardly radially extending tang 25 which  
20 is used to engage in a keyway 26 in the tube 11. The finger 22 in Figures 1 and 2 extends approximately axially from the inner face of the washer 23 at an angle to the inner face. Alternatively, the finger 22 may be in the form of an axially projecting tooth sized to fit within the slot 21.

With the bearing arrangement described relative rotation of the  
25 inner and outer cones of the inner race ring may be prevented. Moreover, relative rotation of the inner race ring with respect to the washer 23 is prevented by means of the cooperating slot 21 and finger 22 which in turn prevents relative rotation of the inner race ring with respect to the tube 11. This reduces fretting corrosion between the inner race ring and the tube and  
30 reduces wear on the tube 11.

Figures 3, 4a and 4b show an alternative design for the locking

ring used with the cones of the inner race ring. The small rib 15' of the cone 12' has the opposing rib flats 18' mentioned above but includes a circumferentially extending groove 27. The groove 27 is located on the small rib 15' and immediately beyond the inner end of the rib flats 18'.

5           As shown in Figures 4a and 4b the locking ring is in the form of a sleeve 17' the inner diameter of which is slightly larger than the outer diameter of the small rib 15'. The sleeve 17' includes ring flats 19' similar to those described with reference to Figures 1 and 2. Also, the sleeve 17' has an axial length which is approximately equal to the sum of the distance from the face  
10 of the small rib on each cone to the far side of the groove 27. Thus, the sleeve 17' encircles the small ribs 15' of the inner and outer cones and extends over the small ribs 15' so as to entirely cover the rib flats 18' and the grooves 27. The sleeve 17' additionally includes lugs 28 which project radially inwardly from the inner surface of the sleeve and are located adjacent the  
15 exposed faces of the sleeve ends. The lugs 28 engage in the grooves 27 of the small ribs 15' when the sleeve 17' is mounted on the cones. With this alternative arrangement the sleeve not only prevents relative rotation of the cones but also acts to hold the cones together by means of the engagement of the lugs 28 in the grooves 27. This can enable the clip 20 to be dispensed  
20 with.

In Figures 5, 6a and 6b an alternative arrangement for holding the cones 12" together and for preventing relative rotation of the cones is shown. The locking ring 17" is similar in shape to that of a clip with a radially outwardly directed channel. The ring 17" is not continuous and instead  
25 terminates with opposing outwardly directed flanges 29. A continuous groove 30 is provided on the inner surface of the small rib 15" which is arranged to receive one of the walls of the channel on the locking ring 17". A slot or recess 31 is also provided extending radially outwards from the inner surface of the small rib 15" between the free end of the small rib 15" and the groove  
30 30. The recess 31 is provided to receive the flanges 29 on the locking ring 17". Unlike the locking rings described with reference to Figures 1 to 4, the

locking ring of Figures 5, 6a and 6b has a diameter, measured from the channel base, which is slightly less than the inner diameter of the small rib 15". Hence, when in use the locking ring 17" is positioned within the ends of the small ribs 15" of both cones 12" and each of the channel walls of the locking ring 17" is engaged in respective grooves 30 in the small ribs 15". At the same time the flanges 29 are commonly located within the recesses 31 of both small ribs 15". The cooperation of the flanges 29 in the recesses 31 prevents relative rotation of the cones 12" whereas the engagement of the channel walls in the grooves 30 ensures the cones 12" are held together. Thus, with this arrangement a conventional clip 20 is replaced by the locking ring 17" described.

The bearing arrangements described above provide the additional benefit that it enables a sensor to be mounted on the inner race ring without the risk of the connecting leads being stretched and broken by the relative rotation of the race ring with respect to the tube 11. Additionally these improved bearing arrangements require no modification of the tube and are easy to assemble. There is a further advantage with the particular embodiments described that the alignment of parts is visible from the end of the shaft 10.

Although the bearing arrangement of Figures 1 and 2 is described mounted on a floating axle arrangement and indeed is suited to use on heavy duty vehicles, it will be appreciated that the bearing arrangement may be used in a wide variety of applications including train wheel axles and rolling units.

**CLAIMS**

1.           A bearing arrangement comprising inner and outer members  
5   which are rotatable relative to each other and rolling elements therebetween,  
the inner member having first and second portions each defining on their  
radial outer surface a raceway and a locking device having means for  
engagement with each of the first and second portions for holding the first and  
second portions in a substantially fixed rotational relationship, and further  
10   including mounting means for engagement with the first or second portions  
and adapted for mounting on a shaft or the like in a substantially fixed  
rotational relationship, the mounting means and the first or second portions  
having cooperating means for holding the mounting means and the first or  
second portions in a substantially fixed rotational relationship.
- 15   2.           A bearing arrangement as claimed in claim 1, wherein each of  
said first and second portions include a discontinuous surface for engagement  
with the locking device.
3.           A bearing arrangement as claimed in claim 2, wherein said  
discontinuous surface is a recess or slot in said first and second portions.
- 20   4.           A bearing arrangement as claimed in claim 3, wherein each of  
said first and second portions has an inner end rib on which said recess or  
slot is located.
5.           A bearing arrangement as claimed in claim 4, wherein said  
recess or slot is positioned on the radially outer surface of the inner end rib.
- 25   6.           A bearing arrangement as claimed in claim 4, wherein said  
recess or slot is positioned on the radially inner surface of the inner end rib.
7.           A bearing arrangement as claimed in any one of claims 2 to 6,  
wherein said locking device includes a discontinuous surface for cooperation  
with the discontinuous surface of said first and second portions.
- 30   8.           A bearing arrangement as claimed in claims 5 and 7, wherein  
said locking device consists of a ring or collar for engagement with the radially

outer surface of the inner end rib, the ring or collar having an inner flat for cooperation with said recess or slot.

9. A bearing arrangement as claimed in claims 6 and 7, wherein said locking device consists of a clip for engagement with the radially inner surface of the inner end rib, the clip having at least one radially outwardly projecting member for cooperation with said recess or slot.

10. A bearing arrangement as claimed in any one of the preceding claims, wherein the locking device may further include lugs or lips for engagement with grooves provided in said first and second portions.

10 11. A bearing arrangement as claimed in any one of the preceding claims, wherein said cooperating means consist of an axially extending projection and groove.

12. A bearing arrangement as claimed in claim 11, wherein said axially extending projection is provided on said mounting means and said groove is provided on at least one of said first and second portions.

13. A bearing arrangement as claimed in any one of the preceding claims, wherein said mounting means further includes at least one radially extending projection for engagement in a keyway provided in the shaft or the like.

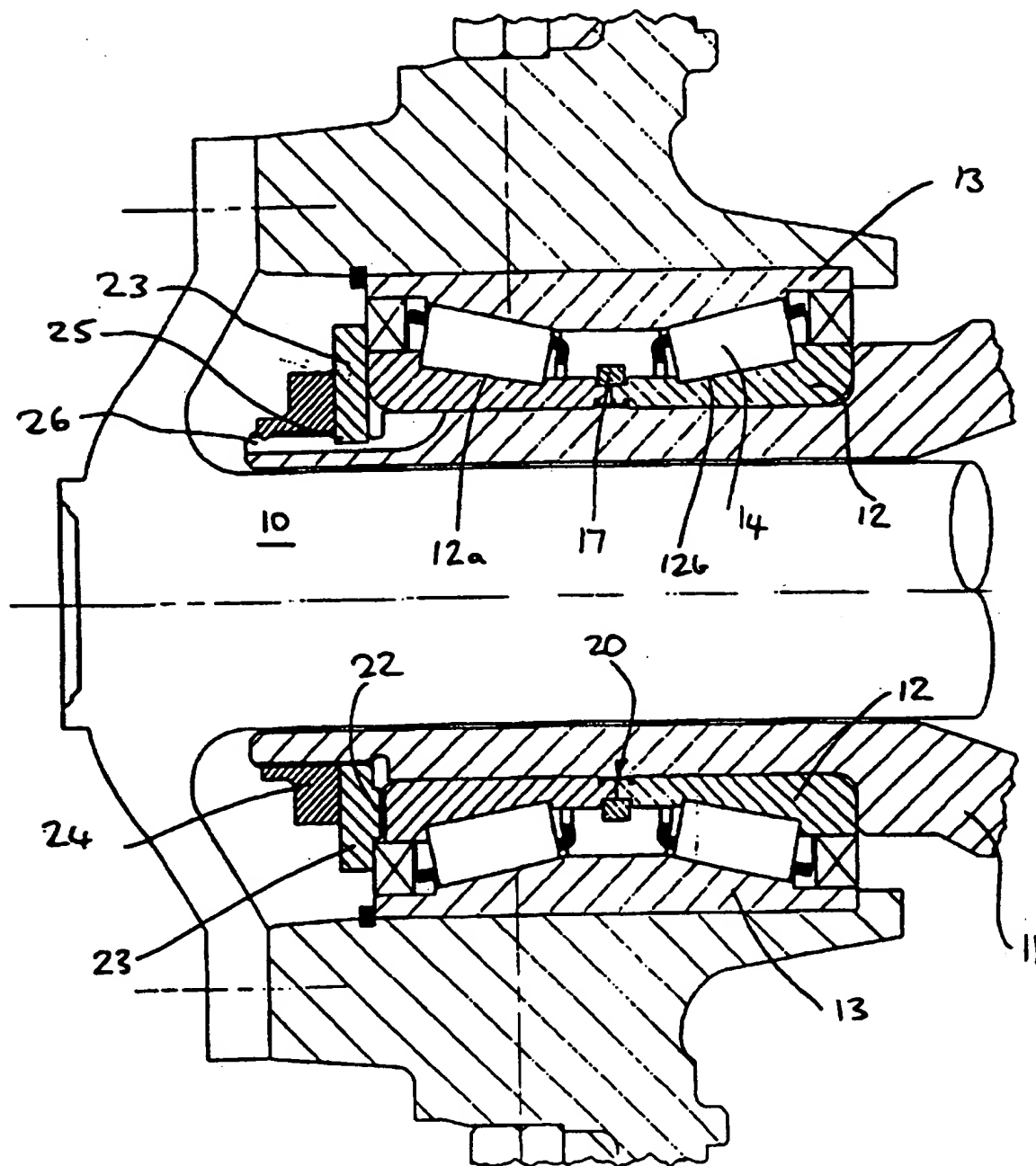
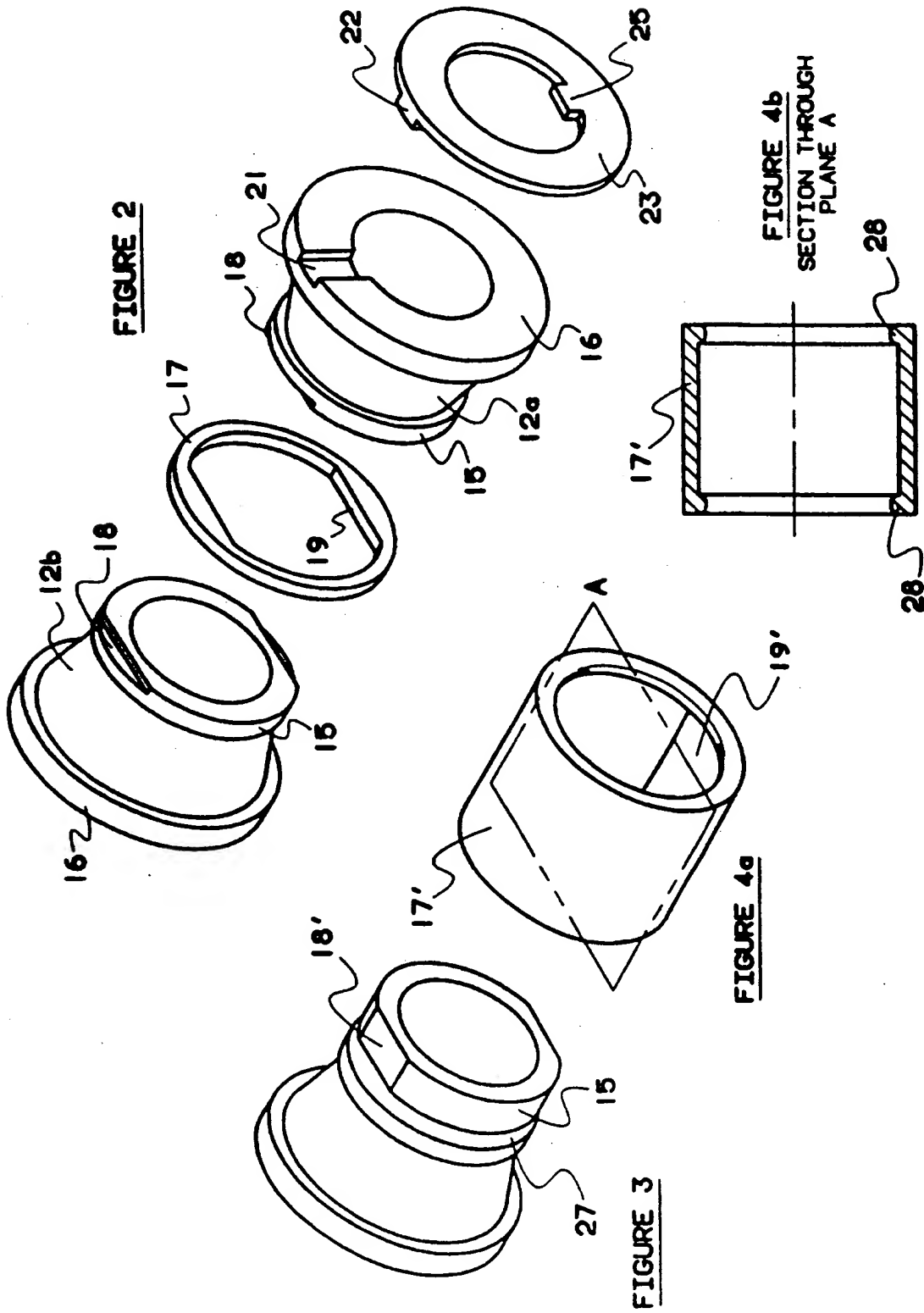
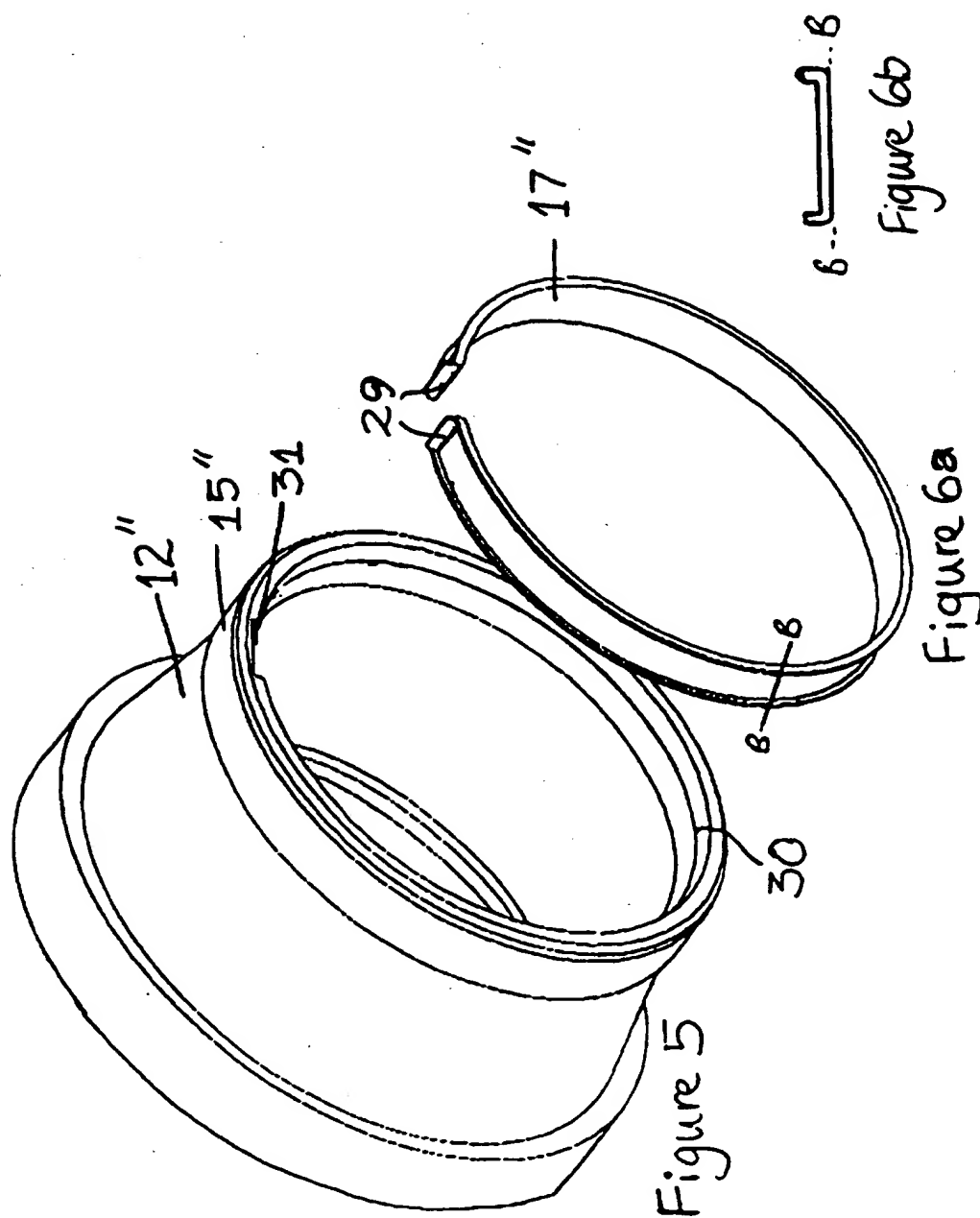


Figure 1





# INTERNATIONAL SEARCH REPORT

Inter national Application No  
PCT/GB 96/00102

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 F16C33/60 F16C35/063

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 F16C B60B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR,A,1 600 909 (SCHAEFFLER) 3 August 1970	1-4,6,7, 9,11,12
A	see page 1, line 27 - line 32	10
A	US,A,1 783 791 (HUGHES) 2 December 1930 see figures 1-4	1-4
A	GB,A,2 269 629 (SKF) 16 February 1994 see the whole document	1
A	WO,A,94 27055 (VOLVO) 24 November 1994 see the whole document	1
A	US,A,3 302 987 (HOFFMANN) 7 February 1967 see figure 4	1
A	US,A,2 615 767 (WALLGREN) 28 October 1952 see the whole document	1
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Date of the actual completion of the international search

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,1 840 552 (ACKERMAN) 12 January 1932 see the whole document -----	1

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Inter nal Application No

PCT/GB 96/00102

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US-A-1783791	02-12-30	NONE	
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		FR-A- 2694793	18-02-94
		SE-A- 9301939	13-02-94
		US-A- 5470165	28-11-95
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US-A-2615767	28-10-52	NONE	
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